

**FBI LABORATORY**

1. A flex circuit apparatus for a disc drive configured to limit a collapse of a chip during a reflow attachment of the chip to a flex circuit substrate, the apparatus comprising:
  - a connection pad and a trace operably disposed on an operating surface of the flex circuit substrate, the trace being adjacently and operably connected to the connection pad; and
  - a barrier that crosses the trace and is configured to limit a flow of material down the trace.
2. The apparatus of claim 1, wherein the barrier is spaced from the connection pad.
3. The apparatus of claim 1, wherein the connection pad has a diameter and the barrier is spaced from the connection pad a distance that is less than one-half the diameter of the connection pad, the barrier being configured to substantially block the flow of material down the trace.
4. The apparatus of claim 1, wherein the barrier contacts the connection pad, the barrier being configured to eliminate the flow of material down the trace.

5. The apparatus of claim 1, wherein the connection pad has a diameter and the barrier is spaced from the connection pad a distance that falls within a range of approximately one-half to two times the diameter of the connection pad.
6. The apparatus of claim 1, wherein the barrier is formed by a cover layer that is selectively deposited on and covers a substantial portion of the operating surface of the flex circuit substrate.
7. The apparatus of claim 1, wherein the barrier is formed by a cover layer that covers the trace and a substantial portion of the operating surface of the flex circuit substrate, the connection pad being exposed, free of the cover layer.
8. The apparatus of claim 1, wherein the barrier is formed by a cover layer that is disposed on a substantial portion of the operating surface of the flex circuit substrate, and wherein the connection pad and a portion of the trace proximate the connection pad are exposed, free of the cover layer.
9. The apparatus of claim 1, wherein:  
the flex circuit substrate further comprises a cover layer  
selectively deposited on the operating surface thereof;  
a length of the trace located between the connection pad and the barrier is exposed and free of the cover layer; and

T03290" 003E6860

the barrier is formed by the cover layer.

10. The apparatus of claim 1, wherein the barrier is formed by a selectively deposited barrier strip disposed on the operating surface of the flex circuit substrate.
11. The apparatus of claim 10, wherein the barrier strip is constructed of a cured dry film solder mask.
12. The apparatus of claim 10, wherein the barrier strip is constructed of a cured liquid photoimageable solder mask.
13. The apparatus of claim 1, wherein:
  - the flex circuit substrate further comprises a cover layer that is disposed on the operating surface thereof and includes an open area where the operating surface is exposed and free of the cover layer;
  - the connection pad and a length of the trace proximate the connection pad are located within the cover layer open area; and
  - the barrier is formed by a barrier strip disposed on the operating surface of the flex circuit substrate and located within the cover layer open area.

09893800-062801

14. The apparatus of claim 1, further comprising a plurality of leadless connection pads electrically disconnected from, and disposed on the operating surface of, the flex circuit substrate, the leadless connection pads being configured to vertically support the chip and limit the collapse of the chip during reflow attachment.

15. A method for limiting a collapse of a chip during a reflow attachment of the chip to a flex circuit substrate, the method comprising:

obtaining a chip having a connection surface that includes a plurality of connection bumps;

obtaining a flex circuit substrate that includes an operating surface having a plurality of connection pads that substantially align with the plurality of connection bumps, at least one of the connection pads being a non-operational traceless pad;

positioning reflowable material on the plurality of connection pads; and

connecting the plurality of connection bumps to the corresponding plurality of connection pads.

16. A flex circuit apparatus, comprising:

a chip;

a flex circuit substrate; and

means for limiting a collapse of the chip during a reflow attachment of the chip to the flex circuit substrate.

109893800-062801

17. The flex circuit apparatus of claim 16, wherein the means for limiting the collapse of the chip comprises a barrier that crosses the trace and is configured to limit a flow of material down the trace during the reflow attachment.

18. The flex circuit apparatus of claim 17, wherein the flex circuit substrate includes a connection pad and a trace operably disposed on an operating surface thereof, the trace being adjacently and operably connected to the connection pad, and wherein the barrier is formed by a cover layer disposed on the operating surface of the flex circuit substrate, the connection pad and a portion of the trace proximate the connection pad being exposed and free of the cover layer.

19. The flex circuit apparatus of claim 17, wherein the barrier is formed by a selectively deposited barrier strip disposed on the flex circuit substrate.

20. The flex circuit apparatus of claim 16, wherein the means for limiting the collapse of the chip comprises at least one non-operational leadless connection pad electrically disconnected from, and disposed on an operating surface of, the flex circuit substrate, wherein the at least one non-operational leadless connection pad is configured to vertically support the chip and limit the collapse of the chip during the reflow attachment.

10893800-062801  
FD3290-008E5860